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ABSTRACT

The report represents the efforts of two schools of higher education in northern Wisconsin to keep Lake Superior, the largest surface area, fresh water lake in the world, close to the condition it was in thousands of years ago when it was formed. The University of Wisconsin-Superior and Northland College have been studying, since 1972, water quality in the streams draining into Lake Superior from Wisconsin in the Ashland, Bayfield, Douglas, and Iron County areas. At Superior, the group responsible for the water quality study has been the Center for Lake Superior Environmental Studies. At Northland College, the group responsible is composed of members of the biology, chemistry, and geography departments. This report is directed toward those people in the Bayfield County area who are interested in water quality. Included are comments on the present water quality of the south shore region, what kinds of interrelated decisions are going to have to be made in northern Wisconsin in the next ten years, an overview of national and state water quality standards, and a specific description of the water quality in Bayfield County. The report also identifies public interest groups and organizations that offer help on water quality problems. (BT)

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WATER QUALITY IN BAYFIELD COUNTY WISCONSIN

Its understanding, preservation, utilization

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A CLEAR LAKE, A CLEAN LAKE BASIN

The people of northern Wisconsin are fortunate in that they live close to the largest surface area, fresh water lake in the world: Lake Superior. Lake Superior may also be the cleanest lake in the world, and probably resembles closely the condition it was in thousands of years ago when it was formed. Any body of water so clean and so cold will also be fragile in that it is possible for irreparable environmental damage to occur unnoticed. Lake Superior could be degraded and changed considerably and irretrievably before anyone detected signs of damage.

Fortunately, two schools of higher education in northern Wisconsin, funded by Title I of the Higher Education Act of 1965 have been studying, since 1972, water quality in the streams draining into Lake Superior from Wisconsin in the Ashland, Bayfield, Douglas and Iron County areas. These two schools are the University of Wisconsin-Superior and Northland College, Ashland. At Superior, the group responsible for the water quality study has been the Center for Lake Superior Environmental Studies (CLSES). At Ashland, the group responsible is composed of members of the Biology, Chemistry and Geography Departments.

This is a report to those people in the four county area who are interested in water quality; for water belongs to all of the people. Specifically, this report will include some comments on what water quality of the south shore region looks like now, what kinds of interrelated decisions are going to have to be made by the people in northern Wisconsin in the next ten years, an overview of national and state water quality standards and a specific description of the water quality in the four county area.

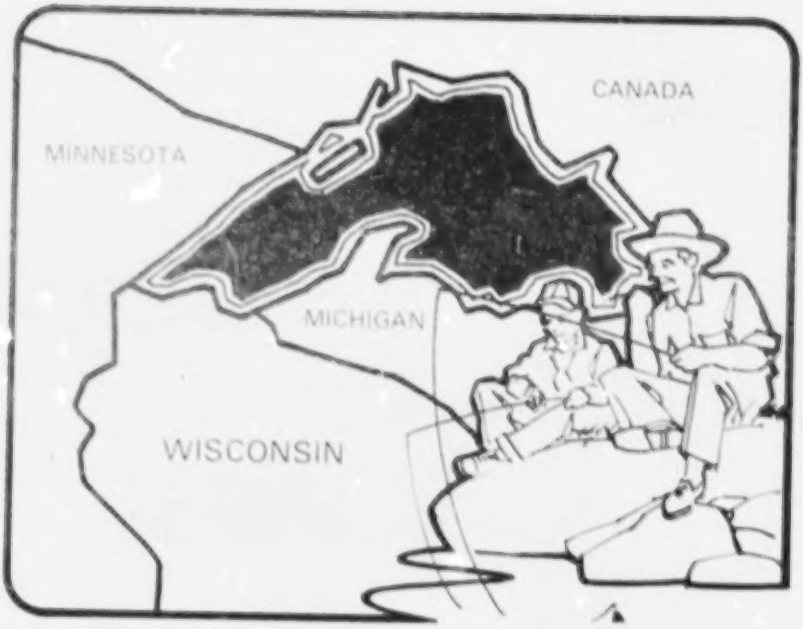
Let us first consider the quality of the water in Lake Superior. We mentioned before that Lake Superior has very clean and cold water. The lake is geologically and biologically a young body of water, and the least studied of all the Great Lakes. There is very little data known relating to the winter season, about what lives on the bottom of the lake, what the characteristics of the bottom of the lake are, and what kinds of fish live in the deep parts or in the middle of the lake. It is true that Lake Superior is a delicate lake and disastrous changes can occur to the lake without being detected. An almost insignificant increase in the cloudiness (turbidity) of the water, for example, will result in significant food loss for fish because the organisms that fish live on will not be able to grow. The amount of solids in the water can also prevent some fish eggs from hatching. For instance, the Lake Trout has a long egg incubation period, as long as two or three months. If solids put into the lake by man smother the eggs, the Lake Trout fishing could be destroyed in Lake Superior. The lake biota is also sensitive to certain metals, such

as copper, iron, mercury and zinc. These metals are poisonous to organisms even at low concentrations. This problem is compounded by the fact that these metals will remain in the lake for a long period of time due to its slow flushing rate (the rate at which the water in a lake is replaced). Concentrations of toxic metals that range from 2 to 50 parts per million can seriously affect a fish that is used to the clean water of Lake Superior. That portion of the lake most important to the survival of the fish, the shallow portion, is also nearest to centers of population and thus even more subject to man-made pollution.

Concerning water quality, we usually think of five kinds of pollution: dissolved solids pollution (we mentioned what effect this has on fish eggs), chemical pollution (such as heavy metals which can kill fish in the lake, and pH problems), oxygen depletion, bacterial pollution (when bacterial pollution is mentioned in this booklet, we are referring to fecal coliform bacteria, which come from human and animal waste), and thermal pollution.

Oxygen that is in solution in water is termed dissolved oxygen and provides the oxygen for respiration for fish and bacteria. Therefore dissolved oxygen is a necessary ingredient for a balanced water environment.

Nutrients from human waste, animal waste or surface runoff in the form of organic matter may cause a reduction in the dissolved oxygen in the water because oxygen is consumed when these



nutrients are decomposed. The oxygen deficiency resulting from this decomposition may kill fish or prevent them from reproducing, and also result in water taste and odor problems. At first glance, it appears beneficial to have more food in the lake, with the assumption that we would have more fish, but let us take a look at what could happen to a very deep cold lake if food is added in the form of organic material. The animal life in the lake is accustomed to a low concentration of food and if the concentration would increase, the organisms would use up more of the dissolved oxygen in the lake than under normal circumstances, thus possibly depleting the oxygen content of the upper layers of the lake. Some of the nutrients would settle to the bottom of the lake. These nutrients could cause oxygen to be used up on the lake bottom. Since there is very little mixing of water layers in a deep lake, except in the Spring and Fall, this oxygen depletion in a deep lake would be relatively permanent. The depletion of the oxygen at the bottom of the lake would kill deep water fish. Oxygen depletion has occurred in Lake Superior in localized areas such as the Duluth-Superior harbor and near the mouth of the Montreal River. Several other rivers in the Wisconsin Lake Superior Drainage basin are possible sources of oxygen depletion.

Bacterial pollution can be detected by standard methods and a check of Lake Superior will find that its bacterial count is low. Usually any great problems of bacterial contamination have occurred near some tributary of the lake. For instance, the St. Louis River, the Duluth-Superior harbor area, the Ashland inshore area and portions of the Montreal River have had instances of bacterial pollution.

Any lake that has water quality as high as Lake Superior does, must have relatively clean streams flowing into it. Studies by the Title I Project carried out by the University of Wisconsin-Superior and Northland College bear out this conclusion. The general water quality in the rivers studied has been above state standards, except in one small stream heavily polluted by nitrates, and in some instances of bacterial pollution which we talked about concerning Lake Superior. Minor pollution problems exist along some stretches of various streams.

What does all this talk of water quality mean to you? What kind of a stake do you have in water quality? It is rather easy to answer the question if you are a sportsman or fisherman or if you like to go swimming or if you drink the water, because people who use the water have a stake in its cleanliness.

WHY NOT POLLUTE?

What are some of the advantages of allowing water to become polluted? We could list them, they are largely economic and largely short-termed. If you have clean water and you are a manufacturer who uses water in the manufacturing process, the cost of your product will be less if you do not clean up your water because you can let polluted waste fluids flow down any stream into Lake

Superior and nobody will know, at least for some years. Or how about a city that dumps raw sewage into the river? The rivers will take the raw sewage and dump it into the lake. You won't have to worry about that sewage but you will be preventing people from fishing and swimming downstream from your sewage pipe. In the short-run, it is cheaper for a company who has an oil spill not to clean it up, but you wouldn't be too happy if that oil found its way to your beach. It is cheaper for boat owners not to have proper toilets on their boats, and it is cheaper to dump your wastes into the lake than to take care of them properly. These are short term savings.

If we go after these short term economic "benefits", in the long run, Lake Superior will environmentally age in a hurry, and we won't have the clean water for boating, fishing, and for living that we have now, so in the long run we have an important stake in maintaining clean river waters.

How can we keep the water clean? Probably the best answer to that question is: don't put any pollutants into the water. This can be accomplished only by installing proper municipal sewage systems, by being careful how we use pesticides and fertilizers, by keeping our water-craft in good repair and by noticing what other people are doing; that is, citizens have an obligation to see to it that all members of a community contribute to clean water.

EFFECTS OF CHANGES ON WATER QUALITY

We mentioned a little earlier that a change in turbidity and nutrients can affect the amount of dissolved oxygen in the water thereby killing off fish and other desirable animals and plants. At the same time a "home" is constructed for less desirable plants and animals.

pH

A change in pH will affect water taste and will affect the breeding habits of fish. pH is used as a measure of the acidity or alkalinity of water. For example, the pH of 1 is very acid, a pH of 7 is

neutral, and a pH of 9 means that the water is alkaline. Vinegar has a pH of approximately 3. One quart of vinegar added to a 25 gallon tank of water of pH 7 would change the pH of the whole tank to 5. The greater the deviation of a liquid's pH from that of 7, the easier it will corrode metal objects, and thus become polluted with metals. If you have any lead pipes in your water supply system, for example, the more acidic your water is, the greater the possibilities of lead poisoning.

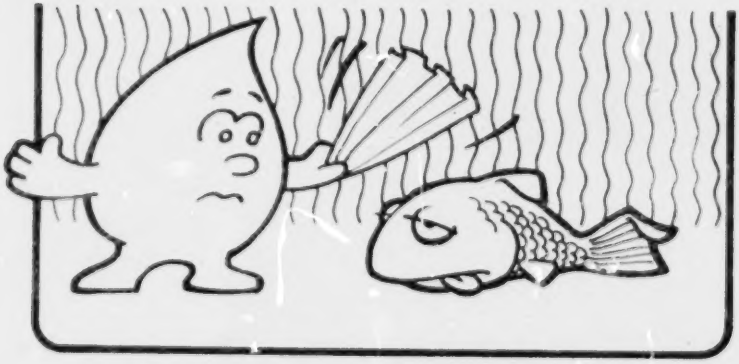
Fecal coliform

A change in the bacteria count can cause untreated water to be unfit for drinking and swimming depending on how high the bacteria count is. The higher the count, the more unsuitable it is for people to drink the water or even wash in it.

Temperature

Thermal pollution (an increase in temperature), also has an effect on water quality. A change in temperature could do any or all of the following: increase the possibility of algae blooms; allow germs to live longer in swimming areas; make germs more lethal to fish, causing large fish kills; cause poisons to become more toxic, and killing of fish directly by a temperature increase. Sometimes a 3°F to 5°F temperature increase is enough to kill sensitive fish. Lethal temperatures for certain sport fish are: trout, 77°F; walleye, 86°F; yellow perch, 84-88°F.

A change in temperature will also effect the kind of fish that will become dominant in a stream. The Columbia River of Oregon, for example, is only a few degrees from changing from a stream dominated by trout and salmon to a stream dominated by walleye and smallmouth bass. Increased temperature in Lake Superior could result in increased abundance of alewife. Not only are fish affected directly by a change in temperature, but their food supply is also affected as a higher temperature will tend to encourage the growth of stream-choking weeds.



Toxic materials

Toxic materials have been mentioned before. Many trace metals have an effect on the fish population. Metals such as copper, chromium, mercury and zinc, for instance, can affect fish that are important to recreation and commercial fishing. Lake trout, whitefish and lake herring are quite sensitive to these trace metals. These metals are deposited in Lake Superior from two main sources: natural erosion of rocks containing these metals and industrial activities.

DECISIONS . . . DECISIONS . . .

Now that we have an idea concerning the importance of water quality in our area, you can begin to think about what kinds of decisions concerning pollution and water quality you must make in the next ten years or so. The center of this book contains a section describing the water quality in your county. The water quality appears to be relatively high except possibly for high bacterial counts in portions of some streams. In almost all cases, the amount of solids in the streams are well within water quality standards as is the dissolved oxygen content. The presence of toxic substances in the streams has not been studied except for copper concentrations and iron concentrations. It appears at the present that copper and iron concentrations are not a hazard to public health.

Questions

What water quality means to you depends on several things: where you live, what you do for a living, where you play, and what your responsibilities are to local government. Let's first take a look at how "where you live" could affect what kind of decisions you have to make. For instance, you may live in a town that has a municipal sewage treatment plant. If you do, it may have only primary treatment facilities. In that case, you could, in the near future, be asked to vote on a bond issue in order to finance the construction of a secondary treatment plant. If you live in a town served by septic tanks rather than municipal sewage facilities, you may be faced with the decision of the building of municipal sewage facilities or modifying your septic system to conform with state codes. You may be fortunate enough, however, to live in an area where your sewage treatment facilities will need no changes in the next ten years or so.

"Where you work" is going to have some effect on what kind of decisions you are going to have to make in the next ten years. If you are in the recreational or tourist industry, you may find that your economic interest in clean water will require you to inform your customers about ways to help keep the water they use clean. There are some streams right now in the four county area having bacteria counts so high that swimming in parts of these streams could be hazardous to health.

You may find yourself at an NPDES (explained later in the booklet) permit hearing in order to see that other businesses are required to clean up their discharges into bodies of water of importance to you. If you are connected with an occupation or business located along a stream you may find that the cost of doing business will go up during the next ten years if your sewage facilities do not insure a low enough bacterial count in the stream on which your place of business is located. You may even find that you are discharging toxic materials into a stream and be faced with an alternative method of disposing of your wastes.

Where you play, the type of recreation you are interested in, will be affected by other people's decisions on water quality control, and you may be faced with the task of deciding whether your recreation or someone else's business profits will be maximized. We are reaching a point where municipal wastes, wastes from businesses, and wastes from residential septic tanks may interfere with fishing, swimming, canoeing, tubing, boating and other forms of water recreation.

Local government leaders, however, will find that they have the greatest responsibilities for clean water in the next ten years. Most municipalities in the four county area do not have the secondary sewage facilities which are required by the new water quality standards. Decisions which have to be made then, will not be concerned with whether or not to have secondary treatment facilities, but rather how soon the community can have them installed, what kind of costs are involved and how much help the community can get from the state and from the national government.

NATIONAL WATER QUALITY STANDARDS

Let us now take a look at what the Federal government is doing to help us keep our water clean.

The Environmental Protection Agency (EPA) feels that we have a federal water policy which will clean up our water by 1985 if it can be implemented. Amendments to the Water Pollution Control Act of 1965 were passed by Congress on October 18, 1972. New goals for water quality have now been established along with enforcement provisions that are practical and, even something new — a relatively easy way for the citizen to take part in establishing water quality standards for specific water uses.

Briefly, the 1972 Act (Public Law 92-500), established the National Pollutant Discharge Elimination System (NPDES) which is a new national permit system whose purpose is to control discharge of pollutants into the nation's waters. This permit program is only part of the comprehensive effort set in motion by the 1972 law to prevent, reduce, and eliminate water pollution. This new federal law contains real "teeth", but the states still retain primary responsibility to combat water pollution. The 1972 law has now established a tight regulatory system with detailed requirements.

(Continued on page 9)

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BAYFIELD COUNTY

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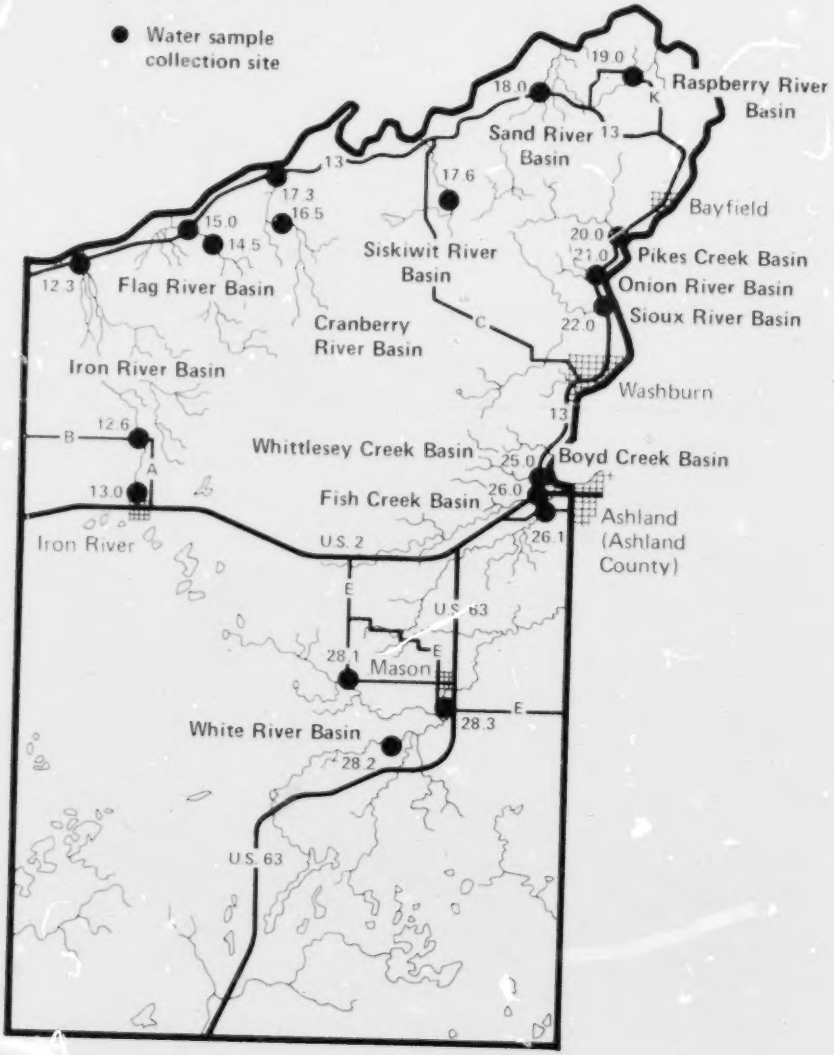

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SPECIFIC DATA

The following river basins were sampled in Bayfield County:

- Iron River Basin
- Flag River Basin
- Cranberry River Basin
- Siskiwit River Basin
- Sand River Basin
- Raspberry River Basin
- Pikes Creek Basin
- Onion River Basin
- Sioux River Basin
- Boyd Creek Basin
- Whittlesey Creek Basin
- Fish Creek Basin
- White River Basin

ANALYSIS

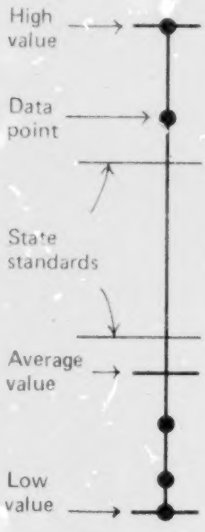
Sampled site locations are indicated on the map on page two.

The results of analysis of the water collected showed that water quality is generally high with no temperature problems. Suspended solids, pH, nutrients, and dissolved oxygen all fell within acceptable limits in each of the basins with the exception of the Boyd Creek Basin. The Boyd Creek Basin will be described in detail later in this section.

The bacteria (fecal coliform) count, however, was high at certain collection points. Water used in recreation should not have more than two hundred bacteria per one hundred milliliters on the average and not more than four hundred bacteria per one hundred milliliters in ten percent of the samples taken in any month.

EXPLANATION OF TABLES AND GRAPHS

The information collected in Bayfield County is offered to you in two forms. Suspended solids, pH, nutrients, temperature, biochemical oxygen demand (BOD) and dissolved oxygen (DO) are presented in tables. The bacteria (fecal coliform) count is presented graphically. Graphs show fecal coliform bacteria by collection site. At each site the high, average (geometric mean) and low counts are symbolized in the manner shown at the right. There are also two horizontal lines on each graph, one at two hundred bacteria per one hundred milliliters (ml) and the other at four hundred bacteria per one hundred milliliters (ml). These symbolize the state standards for fecal coliform counts as explained on page thirteen of this booklet. Each sample collected is symbolized by a round dot.



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IRON RIVER BASIN

The Iron River is formed from Iron Lake and flows northeast into the town of Iron River, Wisconsin, and then northwest into Lake Superior. Mud Lake, which is located one mile north of Iron Lake, contributes water to Iron River also. Tributaries of Iron River in the order of their entry into the stream are: Halls Creek, Muskeg Creek, East Fork, and Resch Creek. The Iron River drains slightly more than 142 square miles and lies in the following political subdivisions of Bayfield County: Orienta, Tripp, Iron River, Hughes, and Oulu. According to the 1970 census, approximately 70% of the 1300 people who live in the Iron River Basin reside in Iron River and the resort country immediately to the southwest of Iron River. The community of Iron River has relatively new sewage treatment facilities and their secondary sewage treatment system discharges treated waters into Iron River, north of the city.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	69.100	0.250	21.890	17
pH in pH units	8.290	7.400	7.730	14
Temperature in ^{0}C	23.000	2.500	14.060	20
Dissolved oxygen in milligrams per liter	11.620	5.900	8.290	20
Biochemical oxygen demand in milligrams per liter	6.970	0.440	1.560	16
Nitrate in parts per million	0.563	0.056	0.194	20
Total phosphate in parts per million	0.962	0.037	0.122	15

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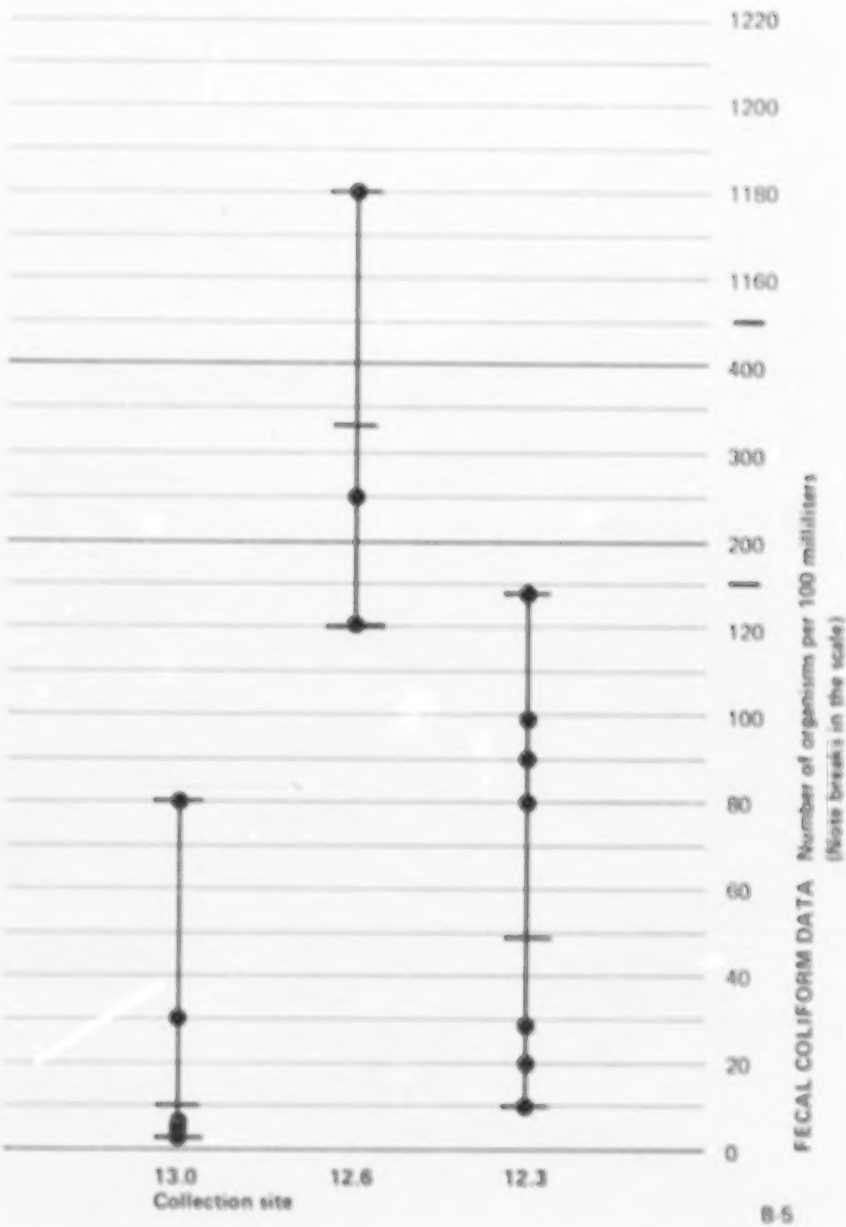

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FLAG RIVER BASIN

The Flag River rises from springs and flows north and northwest into Lake Superior. The largest tributary of the Flag River is the East Fork. Total drainage area is a little over 49 square miles. The basin is located primarily in the Port Wing portion of Bayfield County and has a population of slightly under 400 people. Most individuals live in Port Wing, located on the mouth of the Flag River. Sewage facilities for Port Wing exist in the form of two stabilization ponds located in the "Bibon Lake" area of the mouth of the Flag River.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	488.200	4.950	27.550	10
pH in pH units	8.050	7.500	7.740	10
Temperature in ^{0}C	19.000	8.500	13.360	10
Dissolved oxygen in milligrams/liter	10.330	6.980	9.197	9
Biochemical oxygen demand in milligrams/liter	3.290	0.440	1.310	8
Nitrate in parts per million	0.586	0.026	0.164	10
Total phosphate in parts per million	0.097	0.031	0.067	10

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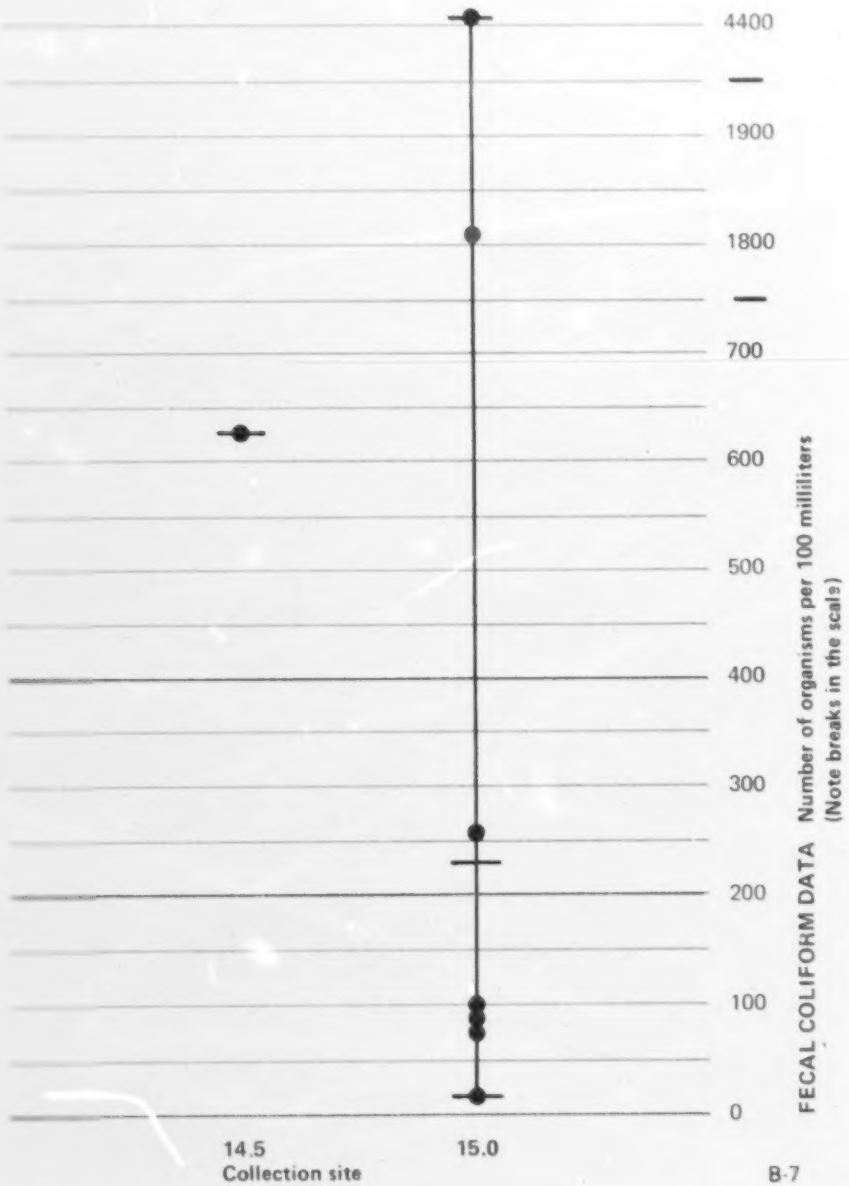

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CRANBERRY RIVER BASIN

The Cranberry River rises as the East Fork and flows north to the Lenawee tributary which joins the East Fork on the township division line. The trunk stream then flows northwest to Lake Superior, draining a basin slightly more than 63 square miles. The Cranberry River Basin is located primarily within the Clover and Port Wing areas of Bayfield County. This basin has a rather stable population of approximately 300 people, the majority of which live in Herbster, located on the east bank of the mouth of the Cranberry River. Sanitation facilities for Herbster exist in the form of private septic tanks.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	473.200	1.300	13.830	8
pH in pH units	7.900	7.500	7.700	8
Temperature in ^{0}C	19.000	11.000	14.000	8
Dissolved oxygen in milligrams/liter	11.300	8.040	9.720	8
Biochemical oxygen demand in milligrams/liter	2.180	0.860	1.370	6
Nitrate in parts per million	0.322	0.042	0.109	8
Total phosphate in parts per million	0.155	0.041	0.072	8

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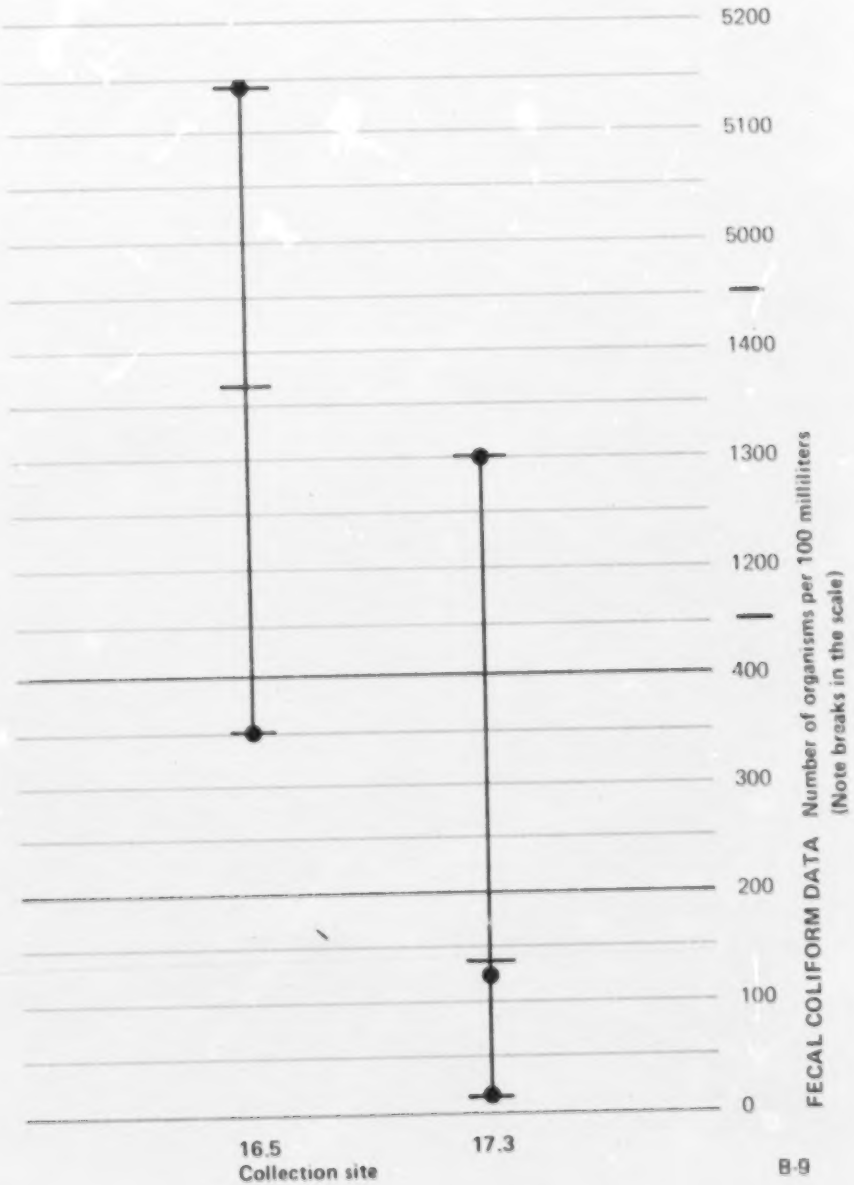

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SISKIWIT RIVER BASIN

Formed from overflow waters of Siskiwit Lake, the Siskiwit River flows northeast through Little Siskiwit Lake and then north eventually into Siskiwit Bay in Lake Superior on the north side of the community of Cornucopia. Sanitation for the village of Cornucopia is taken care of by private septic tanks. This drainage basin of approximately 26 square miles is located almost entirely in the Bayfield County subdivision of Bell. The area contains a population of slightly more than 200 individuals, most of whom live in the village of Cornucopia, which is located immediately west of the Siskiwit River Basin, making the permanent population of the Siskiwit Basin itself closer to 75 than 200.

Cornucopia Harbor, located on the mouth of the Siskiwit River and about one-fourth mile north of Cornucopia, provides a mooring and docking site for fishing and pleasure craft. This harbor has two

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	476.900	0.830	17.079	7
pH in pH units	7.950	7.300	7.697	7
Temperature in °C	18.000	12.000	14.270	7
Dissolved oxygen in milligrams/liter	10.370	7.070	9.119	7
Biochemical oxygen demand in milligrams/liter	4.840	0.680	1.364	5
Nitrate in parts per million	0.489	0.100	0.165	7
Total phosphate in parts per million	0.094	0.071	0.080	5

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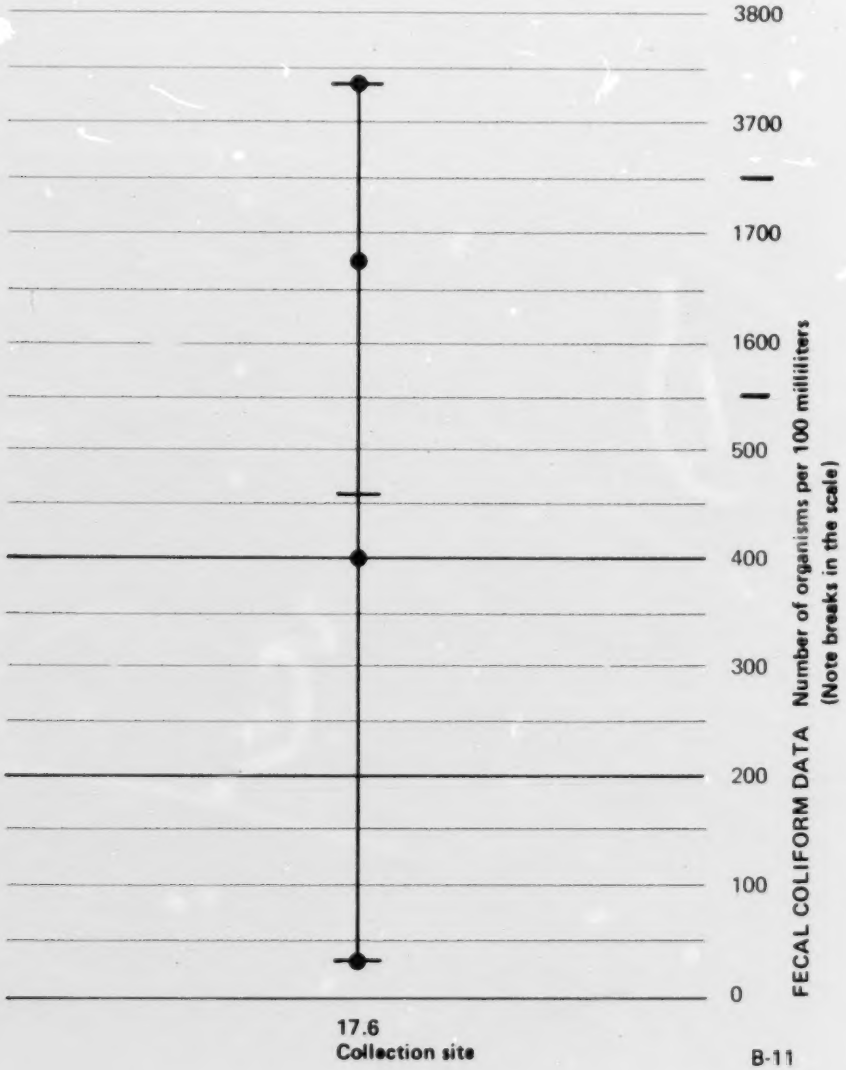
small slips off the main course of the river, plus a long breakwater pier, extending into Lake Superior and which provides protection for permanent docking during the open water season. There are apparently no sources of pollution in the basin with the possible exception of campsites and cabin areas.



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SAND RIVER BASIN

The Sand River flows northeast into Sand Bay, Lake Superior. Racket Creek is the only named tributary and enters the Sand immediately south of the state highway 13 bridge. Approximately 300 people live in the drainage basin which is slightly over 40 square miles in size and lies almost entirely in the Bayfield County subdivision of Bayfield. The western limit of the Red Cliff Indian Reservation is found in the extreme north portion of the basin along the south shore of Lake Superior. No resorts, campground facilities, industries or residential centers are located in the basin and the population is scattered throughout the area, implying that the pollution pressure is probably quite low in the basin. The Sand River has characteristics similar to the Siskiwit and Cranberry Rivers in that the wastes carried by the river are relatively low, but the river does not have a capacity to take on additional organic matter and probably cannot handle a great deal of increased pollution pressure.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	219.100	3.370	40.350	5
pH in pH units	8.050	7.500	7.783	5
Temperature in ^{o}C	19.000	14.000	15.980	5
Dissolved oxygen in milligrams/liter	9.820	7.540	8.568	5
Biochemical oxygen demand in milligrams/liter	2.260	0.830	1.474	4
Nitrate in parts per million	0.233	0.100	0.135	5
Total phosphate in parts per million	0.158	0.041	0.087	5

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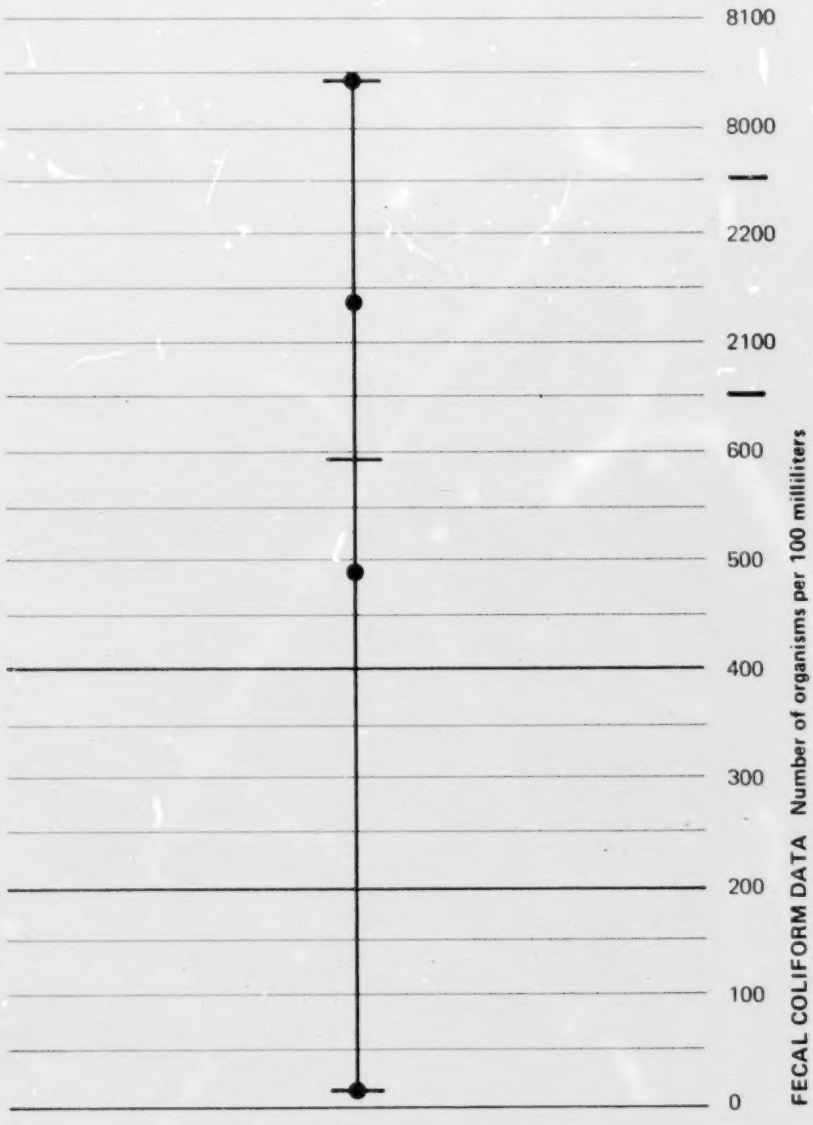

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RASPBERRY RIVER BASIN

The Raspberry River tends to be sluggish as it flows north and northeast to its entry into Lake Superior at Raspberry Bay. This basin drains part of the extreme northeastern section of the Bayfield peninsula. The basin contains approximately 17 square miles and lies entirely in the Bayfield County subdivision of Pussell with a portion of the Red Cliff Indian Reservation also contained within the basin. Approximately 500 people live in the Russell subdivision but probably not more than 100 live scattered throughout the basin because the majority of the people live in two villages, Red Cliff and Sand Bay, both of which lie outside the Raspberry drainage area.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	47.800	12.050	22.123	3
pH in pH units	8.000	7.500	7.717	4
Temperature in °C	15.500	13.000	14.320	4
Dissolved oxygen in milligrams/liter	9.020	7.430	8.290	4
Biochemical oxygen demand in milligrams/liter	2.960	1.120	1.870	3
Nitrate in parts per million	0.859	0.096	0.228	4
Total phosphate in parts per million	0.144	0.045	0.080	3

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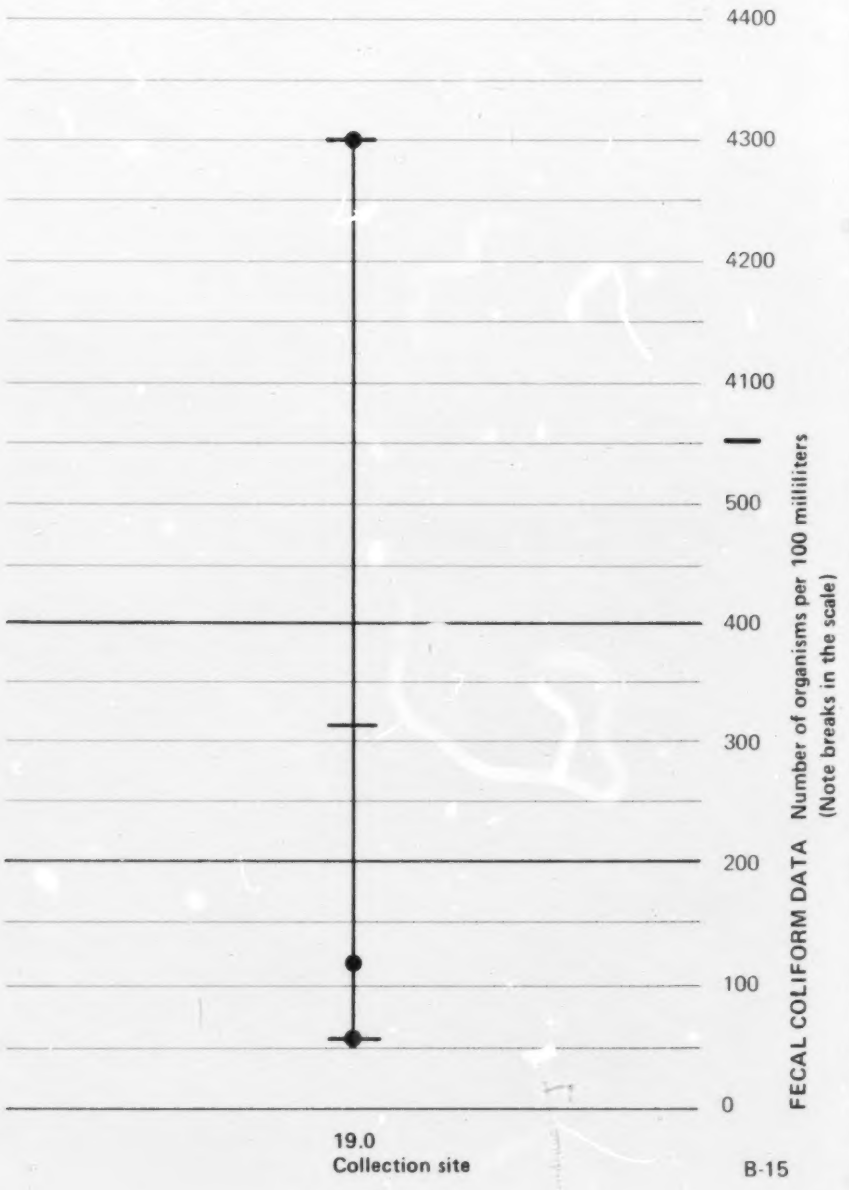

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PIKES CREEK BASIN

Pikes Creek generally flows in an easterly direction to its entry into Pikes Bay, Lake Superior. North Pikes Creek, the only named tributary, joins the main stream and drains the eastern portion of the basin. The headwaters of this creek lie over 400 feet higher than Lake Superior. The basin experienced flash floods in 1942 and again in 1946. The area drained by the basin is approximately 33 square miles. The Pikes Creek basin, containing approximately 250 people, lies in Bayfield County in the subdivisions of Bayfield and Russell. There are no residential concentrations within the basin as the inhabitants live in rural homes scattered throughout the area. A potential source of pollution consists of the Port Superior Marina complex, located near the mouth of Pikes Creek.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	84.000	2.700	14.670	4
pH in pH units	7.700	7.100	7.450	4
Temperature in °C	18.000	7.000	12.000	6
Dissolved oxygen in milligrams/liter	10.600	7.400	9.200	5
Biochemical oxygen demand in milligrams/liter	2.000	1.000	1.500	3
Nitrate in parts per million	0.444	0.083	0.270	4
Total phosphate in parts per million	0.173	0.150	0.161	2

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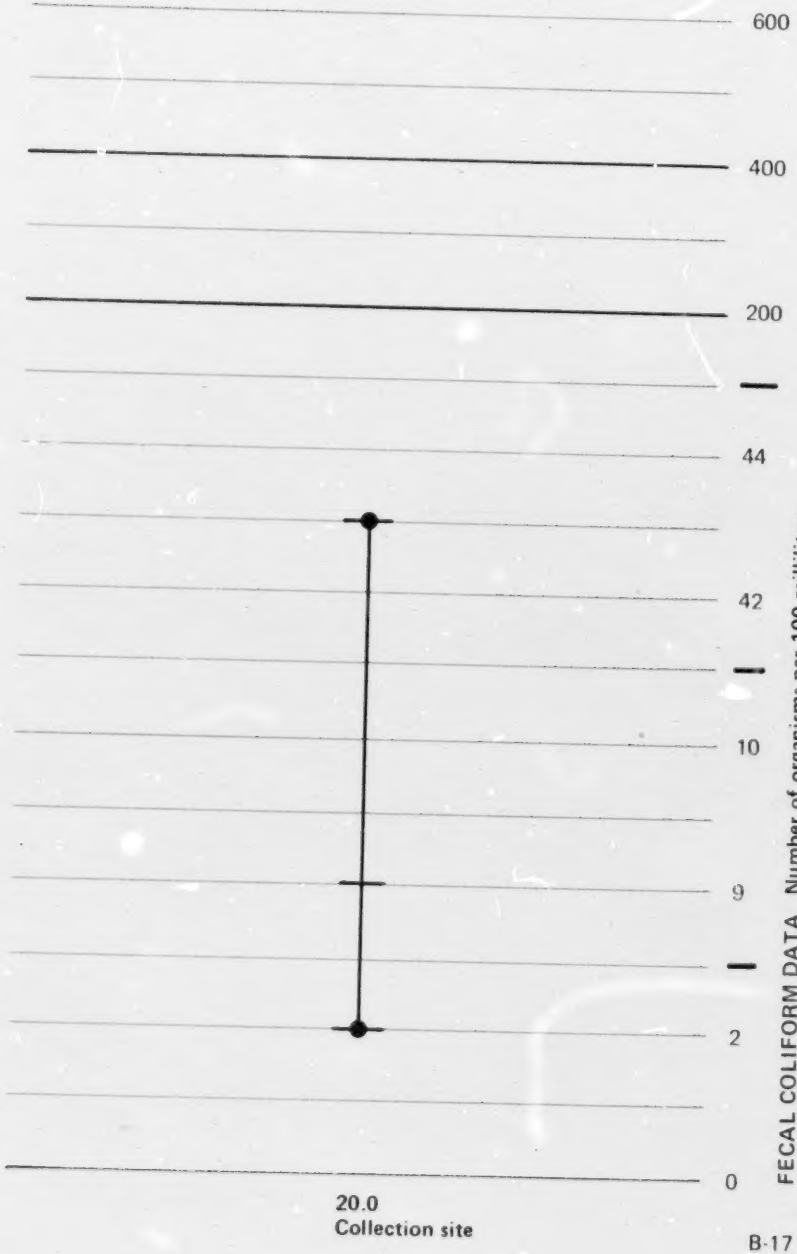

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ONION RIVER BASIN

The Onion River originates in northeastern Bayfield County and flows southeast through the town of Bayfield before entering Lake Superior.

The Onion River Basin is only six square miles in area and contains about 50 people. There are no residential concentrations in the basin, but the Bayfield Campgrounds, a recreation site, is located near the mouth of the main stream and is the only possible site of pollution potential. The stream has a high fishery resource potential and the water quality is currently adequate for maintenance of fish stocks.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	8.400	0.800	2.700	4
pH in pH units	7.900	7.500	7.700	3
Temperature in °C	13.000	7.000	10.400	4
Dissolved oxygen in milligrams/liter	11.100	9.800	10.400	3
Biochemical oxygen demand in milligrams/liter	1.100	0.700	0.890	2
Nitrate in parts per million	0.457	0.406	0.439	3
Total phosphate in parts per million	0.178	0.112	0.141	2

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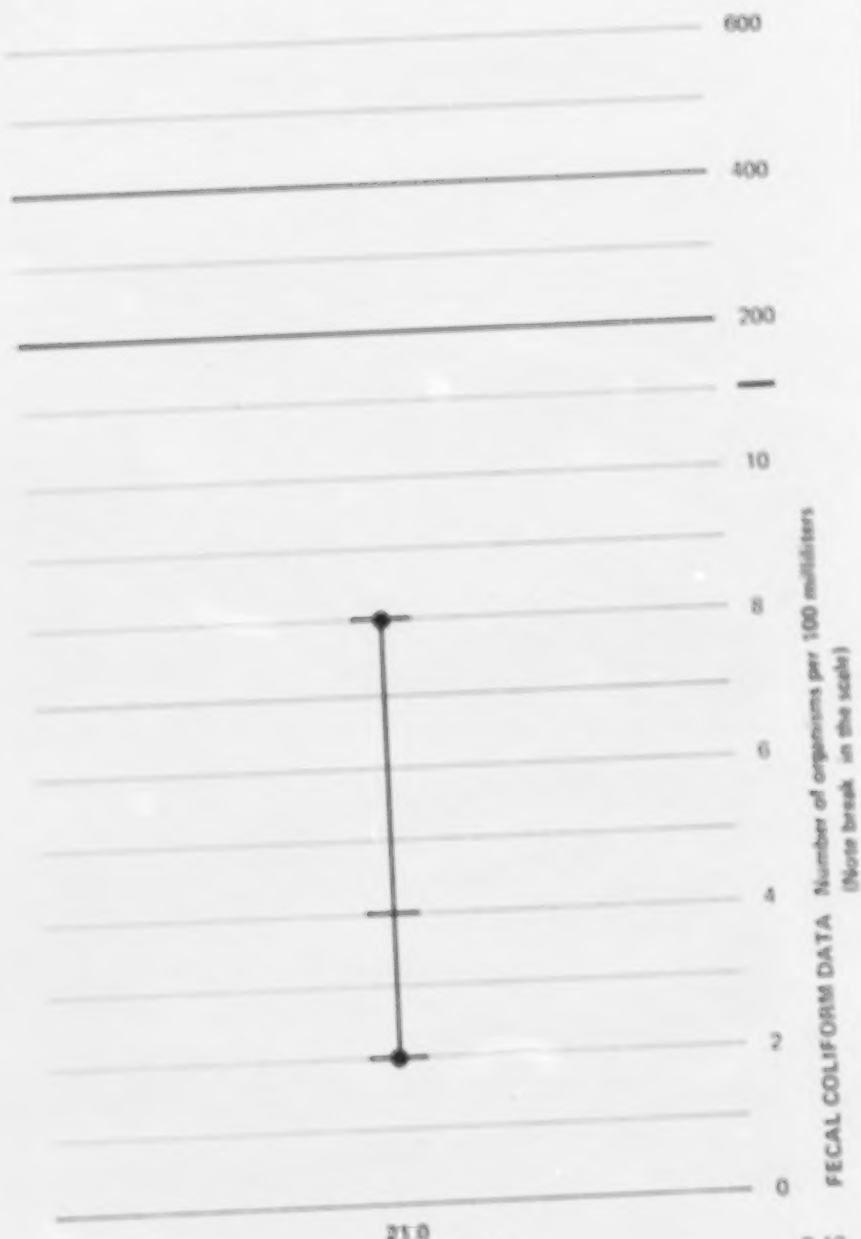

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SIOUX RIVER BASIN

The Sioux River begins in a swampy area and has two main tributaries: Fourmile Creek and the Little Sioux River. The main stream flows in an easterly and northeasterly direction on its way to Lake Superior. The basin drains eighty four square miles and includes parts of the Bayfield County political subdivisions of Washburn, Bayview, and Bell. This region has a population of less than three hundred; however, there are no residential concentrations within the basin. The basin also does not contain any industries of significant pollution potential. The stream apparently is in relatively good condition and the most probable area of water quality degredation occurs in the vicinity of the mouth. If an increased sewage load would occur, it is possible that migration of fish up the river would be blocked on occasion.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	107.000	4.000	15.800	4
pH in pH units	7.700	7.300	7.500	4
Temperature in °C	19.000	6.000	13.000	6
Dissolved oxygen in milligrams/liter	10.700	7.400	9.100	5
Biochemical oxygen demand in milligrams/liter	1.600	1.100	1.400	3
Nitrate in parts per million	0.186	0.109	0.128	4
Total phosphate in parts per million	0.123	0.107	0.115	2
Fecal coliform organisms/100 milliliters	14.000	14.000	14.000	1

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BOYD CREEK BASIN

The Boyd Creek flows easterly into Lake Superior and has poorly developed, unnamed tributaries. During much of the year, the main stream discharges intermittently. The stream drains a basin of less than five square miles and lies entirely in Bayfield County, cutting across the political subdivision of Barksdale. The population of this basin is small, with only scattered farms throughout the region. This small basin would not have been chosen for analysis except that it contains the site for a once important industry: the E.I. du Pont de Nemours & Company Barksdale military explosives plant. In the immediate past the production of this TNT product produced wastes including acid washings, cooling waters, and sellite wastes, or "red waters," which were discharged to a ridge and furrow irrigation system which overflowed into Boyd Creek. Production has stopped at this site and will probably not be resumed in the future. As a result of pollution from this plant Boyd Creek in the past contained no aquatic life. Recent studies however, imply the stream is recovering biologically. Although not expected to add continued pollutants to this basin in the future, this site is still responsible for the addition of nitrates to Boyd Creek due to the leaching of spoil banks found in the area.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
pH in pH units	8.400	7.000	7.500	8
Temperature in °C	21.000	2.000	13.400	9
Dissolved oxygen in milligrams/liter	15.200	7.800	10.300	9
Nitrate in parts per million	4.470	1.340	3.350	10
Total phosphate in parts per million	0.340	0.070	0.139	8

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WHITTLESEY CREEK BASIN

Two spring fed streamlets give rise to the headwaters of Whittlesey Creek. The creek flows southeast to its entry into Lake Superior, flowing underground for almost two and a half miles because of severe sedimentation in the main stream. The only named tributary is the North Fork, although there are several other small tributaries. The area drained by this basin is 25 square miles and is contained within the Barksdale political subdivision of Bayfield County. The basin has a population of less than 300 persons distributed throughout the region.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	78.000	2.800	15.500	4
pH in pH units	7.800	7.500	7.700	3
Temperature in ^{o}C	14.000	7.000	10.800	5
Dissolved oxygen in milligrams/liter	10.900	9.500	10.200	4
Biochemical oxygen demand in milligrams/liter	1.000	0.800	0.900	2
Nitrate in parts per million	0.638	0.212	0.401	4
Total phosphate in parts per million	0.195	0.107	0.144	2

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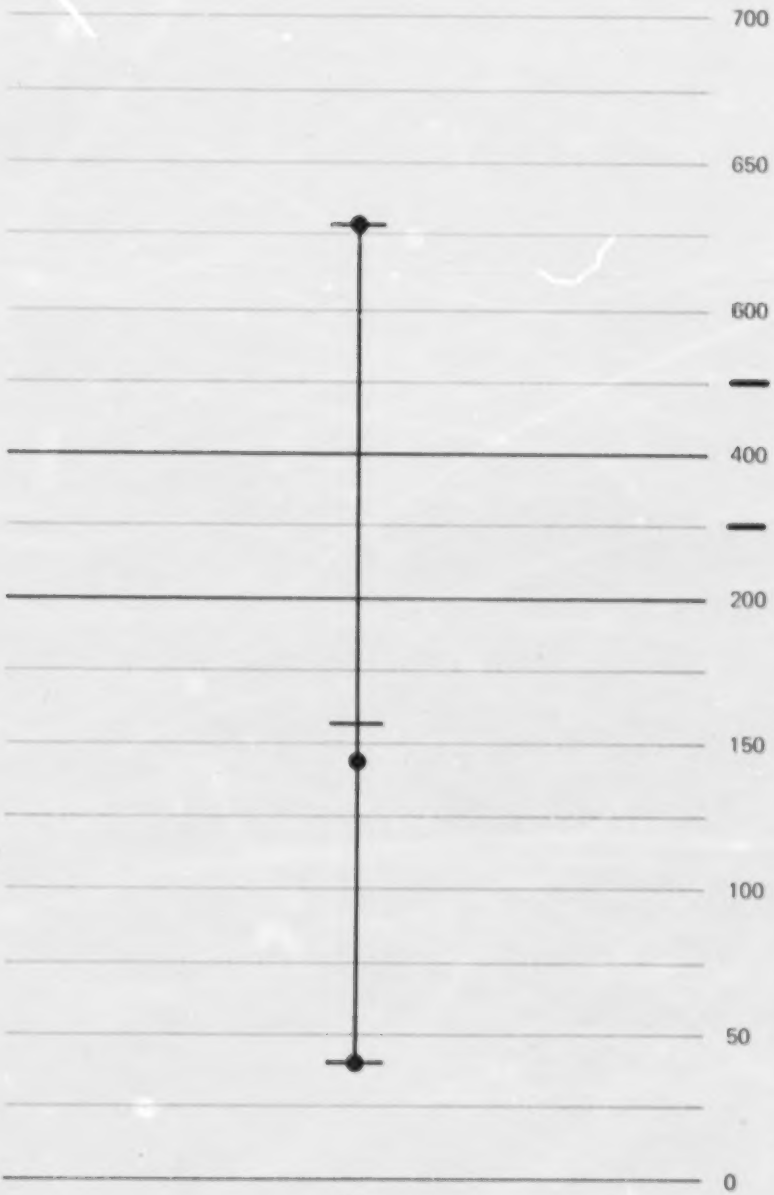

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FISH CREEK BASIN

Fish Creek begins its flow to Lake Superior as a sheet-flow area. It begins as the North Fish Creek and has a contributing inflow from Pine Creek south of Moquah and South Fish Creek entering the main stream near Lake Superior. The main stream flows in a northeasterly direction, entering the lake after draining approximately one hundred forty seven square miles. Fish Creek flows through the Bayfield County political subdivisions of Mason, Delta, Keystone, Kelly, Pilsen, and Eileen. The population of the basin is about one thousand, with no major residential concentrations, although there are several small communities typified by Benoit, Moquah, and Ino. The low potential in the Fish Creek capacity to assimilate waste materials is located at the mouth, and any large addition of waste matter here would exert a detrimental effect.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	748.000	8.500	40.210	8
pH in pH units	7.800	7.400	7.600	8
Temperature in °C	22.000	6.000	14.200	11
Dissolved oxygen in milligrams/liter	10.500	7.100	8.600	9
Biochemical oxygen demand in milligrams/liter	2.100	0.800	1.300	4
Nitrate in parts per million	0.289	0.031	0.172	10
Total phosphate in parts per million	0.315	0.129	0.173	5

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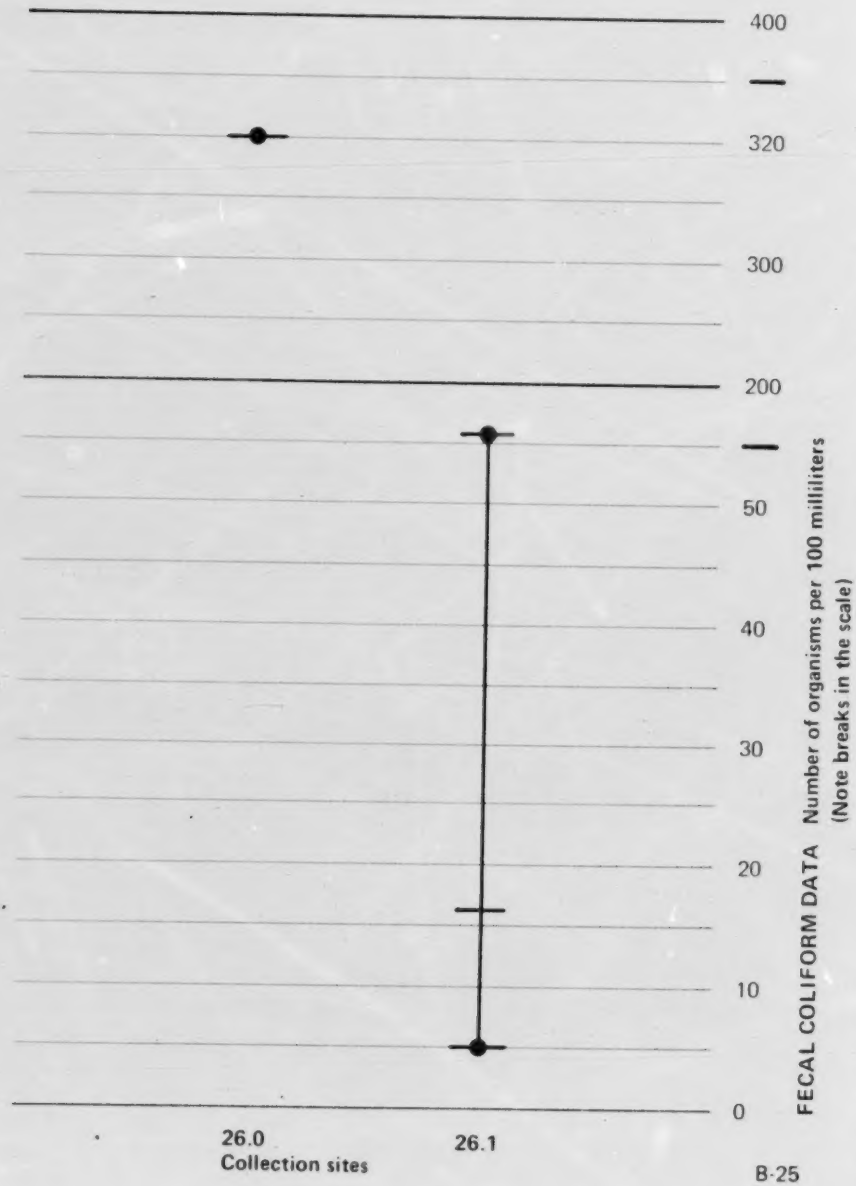

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WHITE RIVER BASIN

The White River begins its flow to the Bad River as several individual streams which originate in different lakes located in west central Bayfield County. The White River covers an area of a little less than four hundred square miles. The population is relatively small in this area with a concentration of approximately one hundred people in the community of Mason. Mason has no public sewage treatment facilities at this time, and most of the basin inhabitants are employed in agriculture. The White River enters the Bad River just south of the town of Odanah.

Water quality variable	Maximum value	Minimum value	Average value	Number of samples taken
Suspended solids in parts per million	19.600	6.300	9.800	9
Biochemical oxygen demand in milligrams/liter	3.500	2.500	2.800	3
Fecal coliform organisms/100 milliliters	30.000	15.000	21.200	2

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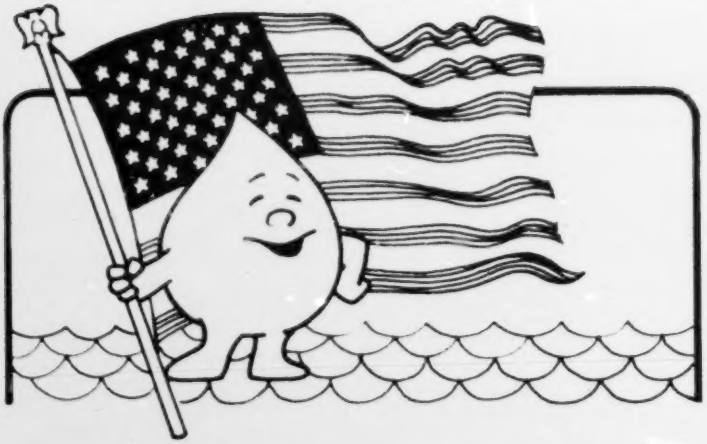
NOTES



streamlined enforcement procedures and heavy penalties for violations. Essential to this system for control of water pollution are these requirements:

1. EPA is establishing national performance standards for sources of water pollution including factories, power plants, sewage treatment plants, and animal feed lots. Maximum amounts of pollution that any one may discharge into a body of water are being established, and some pollutants will not be allowed to be dumped into our waters at all.
2. The law requires industries to use the "best practicable" technology to control water pollution by July 1, 1977 and the "best available" technology by July 1, 1983. The term "best practicable" means that factors such as age of equipment, facilities involved, process employed, process changes, control techniques and environmental impact apart from water quality are taken into consideration. "Best available" technology is the highest degree of technology proved to be desirable for plant scale operation.
3. The law requires publicly-owned waste treatment plants to provide a minimum of "secondary treatment" by July 1, 1983. "Secondary treatment" is a method of purifying waste water using biological processes. It is possible for up to 90 percent of the organic matter in sewage to be removed by making use of the contained bacteria.
4. For various kinds of industrial plants, the EPA will issue separate national performance standards that will set pollutant limits based on the best available demonstrated control technology, including, when possible, no discharges of pollutants at all!

The NPDES permit is the mechanism for insuring that pollution limits are met, that necessary technology is applied, and that all requirements of the 1972 law for controlling discharges and complying with water quality standards are met on schedule. Under the 1972 law, it is illegal to discharge any pollutant into the nation's waters without an NPDES permit.

This does not mean that a permit is a license to pollute. Rather, the permit regulates *what* may be discharged and *how much*. It sets specific limits on what each source may discharge. It commits the discharger to comply with all applicable provisions of the 1972 law. If the discharger cannot comply immediately, the permit sets firm target dates. The permit commits the discharger to reduce or eliminate his discharges in an orderly fashion, in specified steps at specified times. The commitments are legally enforceable. If a permit contains a compliance schedule, each step can be enforced without waiting for final compliance, and clear limits are put on discharges while the discharger is moving toward compliance.

The permit system also requires dischargers to monitor their wastes and to report the amount and kind of its components.

There are two guarantees that an NPDES permit will not become a license to pollute. First of all, if a discharger violates the conditions of a permit or makes illegal discharges without a permit, he could be fined up to $10,000 per day. If a discharger can be shown to have violated the law by willfulness or negligence, he can be fined up to $25,000 per day and be given one year in prison for the first offense, and up to $50,000 per day and two years in prison for subsequent offenses. The EPA can require dischargers to comply with permit conditions by issuing administrative orders, which are enforceable in Federal court, or by seeking court action itself. The second guarantee that an NPDES permit will not be a license to pollute is that the entire permit process has to be carried out with public knowledge. Under the 1972 law, permit applications and proposed permits are available to the public so that the public has an opportunity to attend an open hearing before the permit has been issued or denied. The permit with all conditions and requirements is also a public document and the monitoring information that permit holders must report is also public information. So the NPDES permit system enables any affected citizen to find out *what* a polluter is discharging into the water, *what* the polluter must do, *when* to control the discharge, and *whether* the polluter is meeting the legal requirements imposed by the permit.

Recapping, the intent of the 1972 law is that by July, 1983, wherever possible, all surface water will be water that is clean enough for swimming and other recreational use, and clean enough to protect fish, shellfish, and wildlife. After 1985, no more discharges of pollutants into the nations waters will be permitted. The NPDES permit program is the instrument of progress toward these goals.

STATE WATER QUALITY STANDARDS

The State of Wisconsin has designed water quality standards for all Wisconsin's surface waters and these standards can be found in chapters NR 102, 103, 104 and 105 of the Wisconsin Administrative Code. This portion of the Wisconsin Administrative Code can be

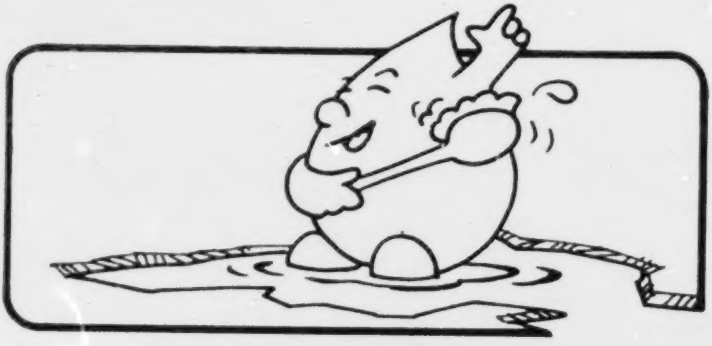
obtained at many Department of Natural Resources (DNR) offices.

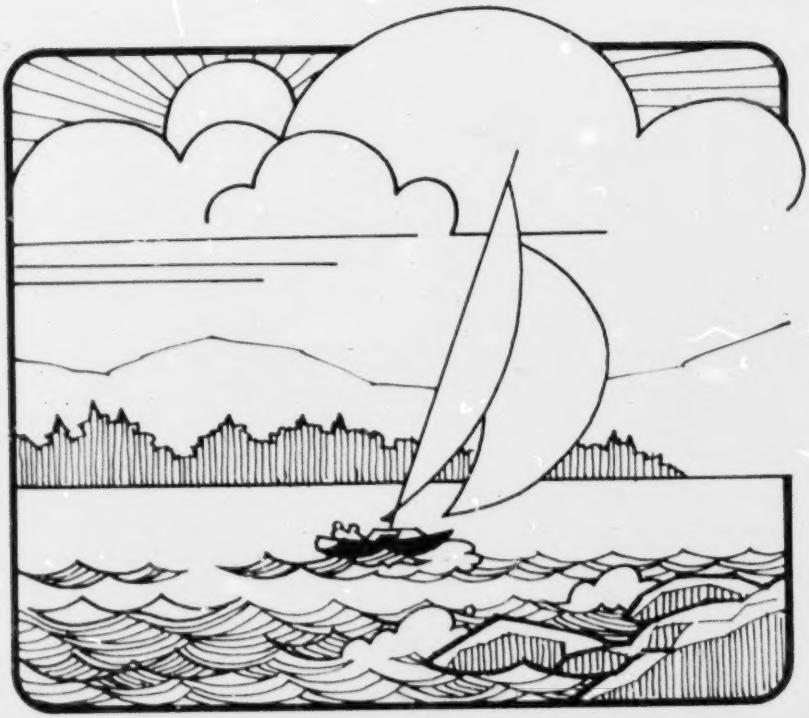
The water quality standards set down in the Administative Code are there because water quality has to be maintained to make water suitable for varied uses. The ultimate goal for water quality in the state is to provide multiuse water for all people and wildlife; water that is aesthetically pleasing, can be used for agriculture, industrial use, we can drink, we can use for power, and not the least of all, we can use for recreation. In short, water quality standards are provided for us in order to protect all the people in the state from misuse of one of our most important natural resources.

Water quality standards are not static. They change with changing needs and changing technology. In fact, the water quality standards for Wisconsin's surface waters, chapter NR 102 and NR 103 of the Administrative Code, has been significantly changed as late as October 1973.

In order for us to better understand the meaning of the water quality set forth in the Administative Code, we are going to look at what those standards might mean to a typical section of a clean river. Let us consider a section twenty feet long, ten feet wide, with an average depth of about five feet so that the volume of the section of the river we are looking at will be 1000 cubic feet.

1. Speaking generally, all waters should meet the following conditions at all times no matter what the rate of flow of the water is, and no matter who is using the water; that is, whether the water is being used for some industrial or commerical use, household use, farm use or recreational use.
   a. There should be no objectional deposits on the shore or in the bed of any body of water.
   b. No objectional material, such as oil or other debris, should be floating or submerged in any body of water.
   c. The right of the public may not be infringed upon by materials that produce any unsightliness or effect the aesthetic quality of the water adversely, such as producing an objectional color or taste.
   d. Toxic substances in concentrations harmful to human life or plant and animal life will not be permitted in the waters of the state.





2. Standards for fish and aquatic life: Waters that are classified for fish and aquatic life must meet the following standards:
   a. Dissolved oxygen: Except for waters classified as trout streams, dissolved oxygen content in surface waters is not permitted to be less than .0007 ounces per gallon (5 milligrams per liter) at any time. That means in our twenty-foot section of river we would have just about a third of a pound of oxygen dissolved as a minimum at any time. If you had a third of a pound of oxygen setting on your back porch, it would easily fit into a twenty-five gallon drum.
   b. Temperature:
      (1) Any temperature change that has bad effects on water life is not permitted.
      (2) Natural temperature changes of water should not be tampered with.
      (3) If warm water is being mixed with the water in a stream or lake, the maximum rise in temperature at the edge of the mixing area should not be more than 5°F for streams and 3°F for lakes. The temperature of a lake or stream should not be raised above 89°F.
   c. pH: The pH should range from 6 to 9 and no change greater than 0.5 units from estimated seasonal averages should

occur. Less than a thimble-full of sulfuric acid could change the pH of our section of stream from 7 to 5. The condition of our water can be fragile and easily changeable at times.

d. No substance that alone or in combination with other materials that may be toxic to fish, or other water life, should be added to surface waters.

e. Trout waters: Standards on trout waters are higher than other waters.

(1) If natural trout reproduction is to be protected, there can be no significant artificial increase in temperature of those waters.

(2) Dissolved oxygen in trout streams should not be less than 0.00080 ounces per gallon (6 milligrams per liter) at any time. During spawning the dissolved oxygen shouldn't be lowered to less than .0009 ounces per gallon (7 milligrams per liter). Six milligrams per liter is the same as 0.37 pounds of oxygen in our section of river at any time. During spawning, no less than 0.44 pounds of dissolved oxygen should be found in our section of river.

(3) The dissolved oxygen in any Great Lake tributary used by stocked salmonids for spawning runs shouldn't be lowered below the natural amount while those fish are in the tributaries.

3. Standards for recreational use: Protection from fecal contamination is the chief determiner of the suitability of surface waters for recreational purposes. In addition, some bacterial guidelines have been established.

a. The fecal coliform count should not be more than 200 per 100 milliliters on the average, and never should be more than 400 per 100 milliliters in more than 10 percent of all samples taken during any month. That means the average number of fecal coliform bacteria in our section of the river should never be more than 3 million.

4. Standards for public water supply: Public water supply waters should meet the standard for fish and aquatic life and recreational use. But they should also meet additional standards where the water is withdrawn for treatment and distribution as drinkable water.

a. Dissolved solids: Dissolved solids should not exceed .07 ounces per gallon (500 milligrams per liter) as a monthly average and they shouldn't exceed .1 ounce per gallon (750 milligrams per liter) at any time. That means that in our section of river the dissolved solids shouldn't be more than 31 pounds as an average and never more than 47 pounds as a maximum at any time.

b. The intake water supply must be such that with appropriate treatment and adequate safeguards it will meet the 1962 Public Health Service Drinking Water Standards.

c. Concentrations of other contituents must not be hazardous to health.

GUIDELINES FOR APPLICATIONS OF STATE WATER QUALITY STANDARDS

1. Fish, waterlife, and recreational use standards are expected to be met by all waters throughout the state of Wisconsin by January 1, 1983. The surface water standards use classifications are to be reached by July 1, 1977. The State recognizes that there will be some small number of situations which will not be controllable by technology by 1983. Some variances from the 1983 water quality standards may be provided for those technical reasons.
2. Anti-degradation: No degradation of water in the state will be permitted unless two conditions are met. The first condition is that the degradation goes along with necessary economic or social development and that the degradation will not injure the waters for any of the uses that are assigned to those waters.
3. Stream Flow: Water quality standards ordinarily apply during fluctuations of stream flow except, possibly, during periods when flows are less than the average minimum 7-day flow (which occurs on the average once in ten years).
4. Mixing zones: Where wastes mix with surface waters, water quality standards must be met outside the area of mixing. The size of this area of mixing is based on the type of waste, the amount of waste, temperature, current flow, type of outflow, shape of channel, and restrictions to fish movement. Mixing zones should meet the following standards:
   a. They should be limited to as small an area as possible.
   b. It should be possible for fish and other water life to avoid mixing zones.
   c. Mixing zones shouldn't take up more than 50 percent of a river's width or 25 percent of the cross-sectional area of the river.
   d. For waste other than heat, one out of every two fish should be able to live in the mixing zone for 96 hours.
   e. Mixing zones should not exceed 10 percent of a lake's total surface area.
   f. Mixing zones should not interfere with spawning or nursery areas, migratory routes, or mouths of tributary streams.
   g. Mixing zones should not overlap but if they do, measures should be taken to prevent wastes from more than one mixing zone to interact, unless the interaction causes no damage.
5. Resource management exemptions: Applications of chemicals for water management resource purposes in accordance with law is not subject to requirements of water quality standards except in the case of water used for public water supply. A variety of methods of enforcement of the standards will be used: financial assistance, industrial incentives, increased surveillance,

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orders, and permits will be used to achieve and maintain the water quality standard. Reasonable time schedules to comply with orders and permits will depend on circumstances. All municipal sewage treatment plants shall provide a minimum of secondary treatment and waste disinfection. Communities with a population of 2500 and over should have an 85 percent reduction of phosphorus on an annual basis, and there should also be removal of industrial waste containing more than .0003 ounces per gallon (2 milligrams per liter) of total phosphorus and having an annual phosphorus discharge greater than 8750 pounds. Any waste water discharger may be required to remove excess amounts of phosphorus where such discharges are causing over fertilization of surface waters.

Where to get help on water quality problems

Wisconsin Department of Natural Resources

Box 450
Madison, Wisconsin 53701
608-266-2121

Box 309
Spooner, Wisconsin 54801
715-635-2101

The Center for Lake Superior Environmental Studies [CLSES]
University of Wisconsin-Superior
Superior, Wisconsin 54880
715-392-8101 Extension 303 and 315

(In 1973 a 210 page report on northwestern Wisconsin river water quality titled, "Wisconsin's Lake Superior Basin Water Quality Study" was published by the University of Wisconsin-Superior and Northland College. If your interest group has not yet received a free copy please write for one at the above address).

Northland College
Ashland, Wisconsin 54806
715-682-4531

PUBLIC INTEREST GROUPS THAT CAN HELP

Business and Professional People for the Public Interest
109 N. Dearborn, Suite 1001
Chicago, Illinois 60602
312-641-5570

Natural Resources Defense Council
1710 N. Street, N. W.
Washington, D. C. 20036
202-484-6368

Environmental Defense Fund
1910 N. Street, N. W.
Washington, D. C. 20036
202-833-1484

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